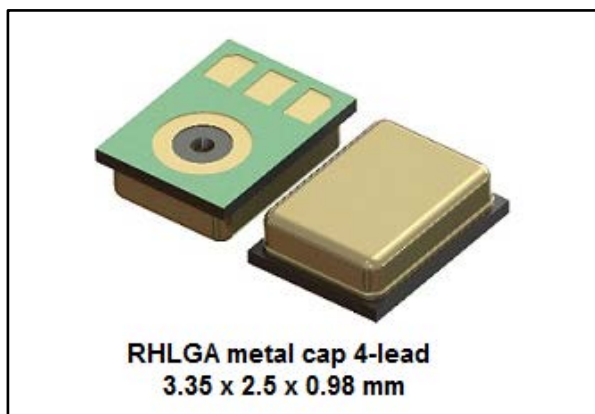


## High-performance MEMS audio sensor: fully differential analog bottom-port microphone

Datasheet - production data



### Features

- Single supply voltage operation
- Fully differential output
- Omnidirectional sensitivity
- High signal-to-noise ratio
- High bandwidth
- Package compliant with reflow soldering
- High RF immunity
- ECOPACK®, RoHS, and “Green” compliant

### Description

The MP23AB01DH is a compact, low-power microphone built with a capacitive sensing element and an IC interface.

The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process to produce audio sensors.

The MP23AB01DH has sensitivity of 38 dB  $\pm 1$  dB, an acoustic overload point of 135 dB SPL with minimum 65 dB signal-to-noise ratio.

The MP23AB01DH has fully differential output in order to minimize common mode noise.

The MP23AB01DH is available in a package compliant with reflow soldering and is guaranteed to operate over an extended temperature range from -40 °C to +85 °C.

**Table 1: Device summary**

| Order code   | Temp. range (°C) | Package                | Packing       |
|--------------|------------------|------------------------|---------------|
| MP23AB01DH   | -40 to +85       | (3.35 x 2.5 x 0.98) mm | Tray          |
| MP23AB01DHTR | -40 to +85       | (3.35 x 2.5 x 0.98) mm | Tape and reel |

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# 1 Pin description

Figure 1: Pin connections

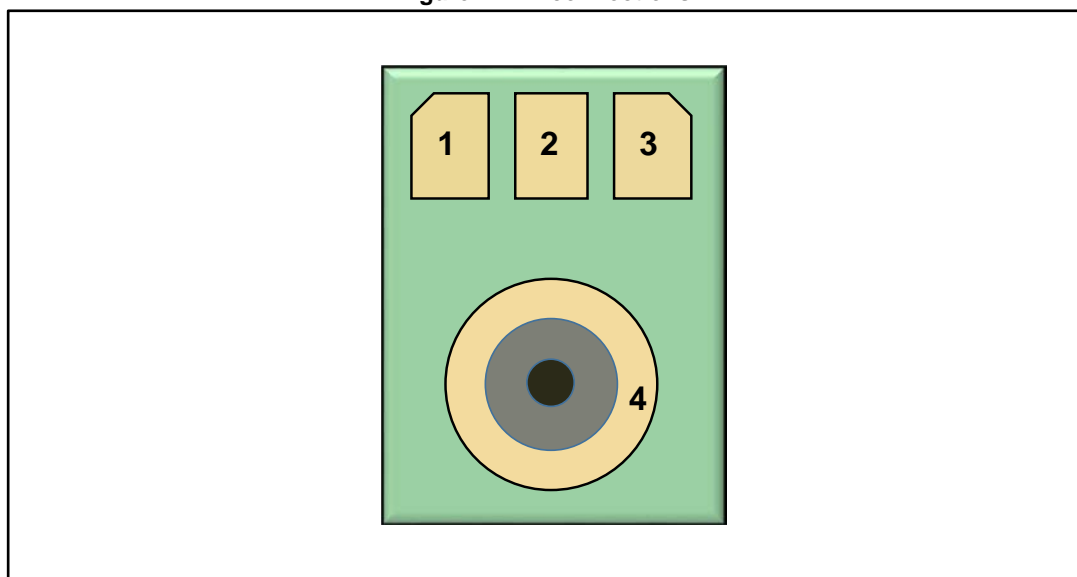


Table 2: Pin description

| Pin number | Pin name | Function               |
|------------|----------|------------------------|
| 1          | Vdd      | Power supply           |
| 2          | Output-  | Negative output signal |
| 3          | Output+  | Positive output signal |
| 4          | Ground   | Ground                 |

## 2 Acoustic and electrical specifications

### 2.1 Acoustic and electrical characteristics

The values listed in the table below are specified for Vdd = 2.7 V, No Load, Tamb = 25 °C unless otherwise specified.

**Table 3: Acoustic and electrical characteristics**

| Symbol | Parameter                   | Test condition                 | Min. | Typ. <sup>(1)</sup> | Max. | Unit   |
|--------|-----------------------------|--------------------------------|------|---------------------|------|--------|
| Vdd    | Supply voltage              |                                | 2.3  | 2.7                 | 3.6  | V      |
| Idd    | Current consumption         |                                |      |                     | 250  | μA     |
| So     | Sensitivity                 | @1 kHz<br>(0 dB = 1 V/Pa)      | -39  | -38                 | -37  | dBV    |
| SNR    | Signal-to-noise ratio       | A-weighted<br>(20 Hz - 20 kHz) | 65   |                     |      | dB(A)  |
| PSR    | Power supply rejection      | 100 mVpp<br>sine wave @217 Hz  |      | -100                |      | dB     |
| AOP    | Acoustic overload point     |                                |      | 135                 |      | dB SPL |
| Zout   | Output impedance            |                                |      |                     | 400  | Ω      |
| Cload  | Load capacitance            |                                |      |                     | 150  | pF     |
| Rload  | Load resistance             |                                | 30   |                     |      | κΩ     |
| Top    | Operating temperature range |                                | -40  |                     | +85  | °C     |

**Notes:**

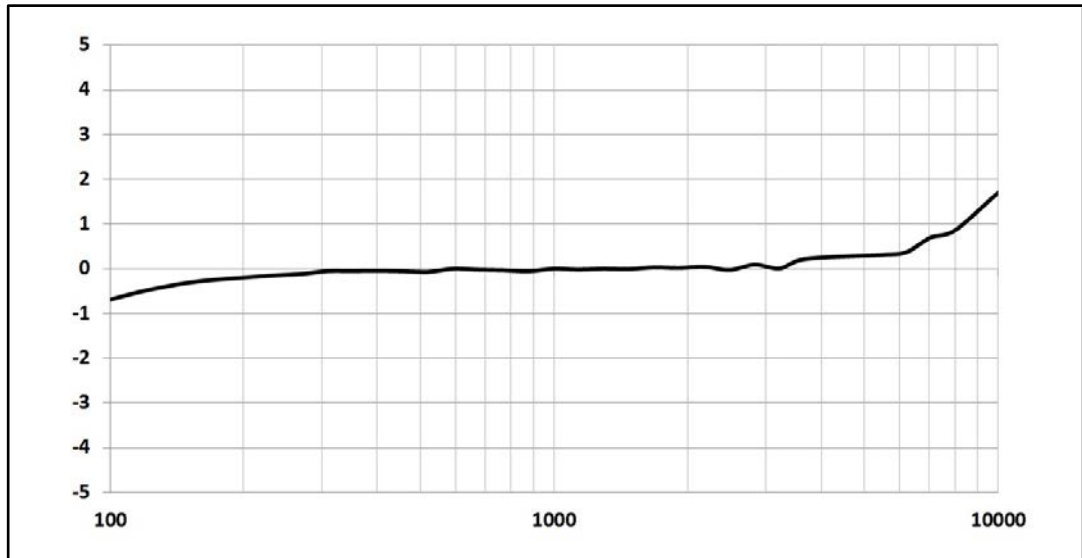
<sup>(1)</sup>Typical specifications are not guaranteed.

**Table 4: Typical distortion specifications at 1 kHz sine wave input**

| Parameter | Test condition | Typ. value |
|-----------|----------------|------------|
| THD+N     | 94 dB SPL      | < 0.2%     |
|           | 110 dB SPL     | < 0.5%     |
|           | 120 dB SPL     | < 3%       |
|           | 130 dB SPL     | < 5%       |

## 2.2 Frequency response

Figure 2: Typical free-field frequency response normalized at 1 kHz



### 3 Absolute maximum ratings

Stresses above those listed as “Absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

**Table 5: Absolute maximum ratings**

| Symbol             | Ratings   | Maximum value | Unit |
|--------------------|---|---------------|------|
| Vdd                | Supply voltage  | -0.5 to 4.8   | V    |
| T <sub>STG</sub>   | Storage temperature range   | -40 to +105   | °C   |
| ESD                | (HBM) ANSI/ESDA/JEDEC JS001   | ±2000         | V    |
| ESD                | (MM) EIA/JESD22-A115  | ±200          | V    |
| ESD                | (CDM) JESD22-C101   | ±750          | V    |
| ESD <sup>(1)</sup> | Per IEC61000-4-2, 3 discharges, 150 pF, 330 Ω direct contact to housing. MIC must be at zero potential before each discharge. | ±8000         | V    |

**Notes:**

<sup>(1)</sup>Bypass capacitor 200 nF or 1 μF (better), is definitely recommended for ESD main clamp integrity.



This device is sensitive to mechanical shock, improper handling can cause permanent damage to the part.

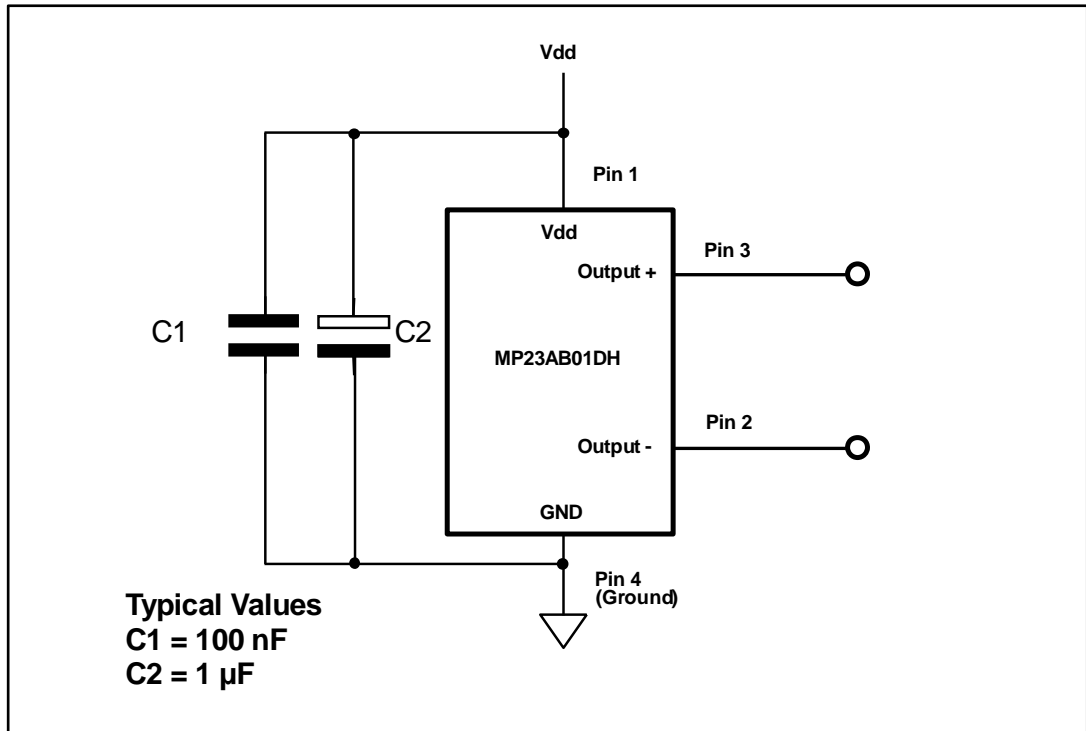


This device is sensitive to electrostatic discharge (ESD), improper handling can cause permanent damage to the part.

## 4 Application recommendations

### 4.1 MP23AB01DH schematic hints

Figure 3: MP23AB01DH electrical connections and external component values



## 5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

### 5.1 Soldering information

Figure 4: Recommended soldering profile limits

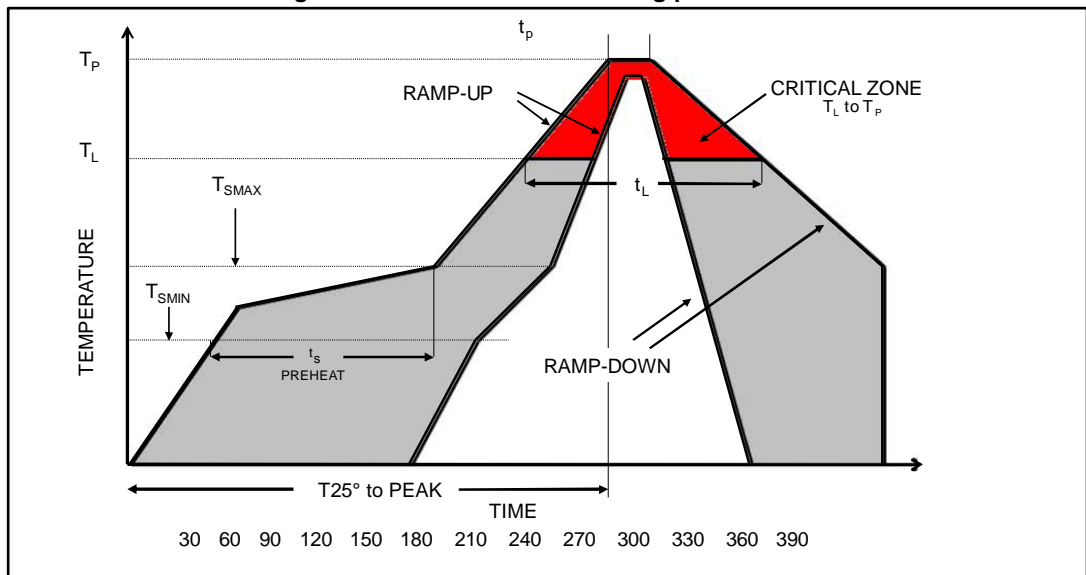


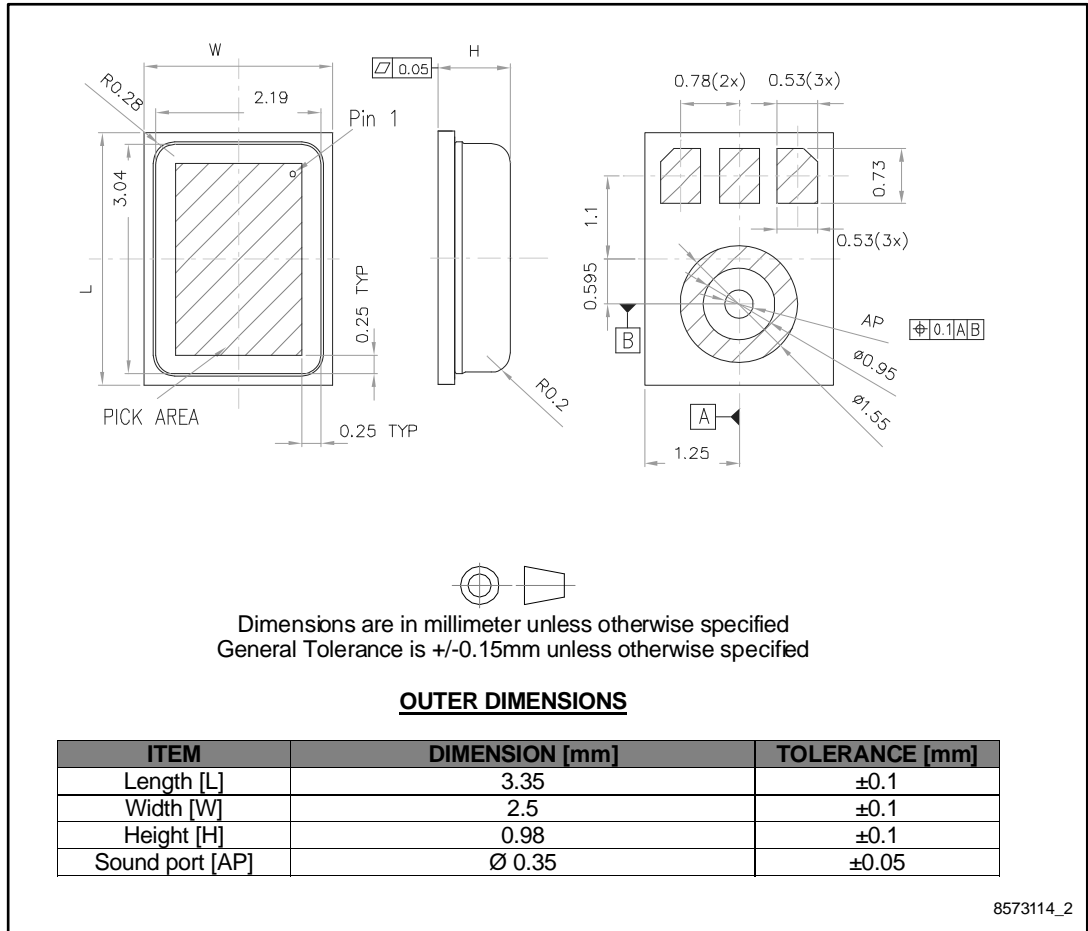
Table 6: Recommended soldering profile limits

| Description  | Parameter                         | Pb free                               |
|--|-----------------------------------|---------------------------------------|
| Average ramp rate  | $T_L$ to $T_P$                    | 3 °C/sec max                          |
| Preheat  | $T_{SMIN}$<br>$T_{SMAX}$<br>$t_s$ | 150 °C<br>200 °C<br>60 sec to 120 sec |
| Ramp-up rate   | $T_{SMAX}$ to $T_L$               |                                       |
| Time maintained above liquidus temperature<br>Liquidus temperature | $t_L$<br>$T_L$                    | 60 sec to 150 sec<br>217 °C           |
| Peak temperature   | $T_P$                             | 260 °C max                            |
| Time within 5 °C of actual peak temperature                        |                                   | 20 sec to 40 sec                      |
| Ramp-down rate   |                                   | 6 °C/sec max                          |
| Time 25 °C ( $t = 25$ °C) to peak temperature                      |                                   | 8 minutes max                         |



## 5.2 RHLGA 4-lead package information

Figure 5: RHLGA metal cap 4-lead (3.35 x 2.5 x 0.98 mm) package outline and mechanical dimensions



## 6 Reliability tests

The device passed all reliability tests on three different assembly lots under the following conditions given in the table below.

**Table 7: Tests and summary of results**

| Test name  | Description  | Conditions   |
|--|--|--|
| <b>HTOL:</b> High Temperature Operating Life                     | The device is stressed in dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature, load current, internal power dissipation. | Vdd(max) = 3.6 V;<br>Tamb = 125 °C<br>JESD22a108                         |
| <b>HTS:</b> High Temperature Storage                             | The device is stored in an unbiased condition at the maximum temperature allowed by the package materials, sometimes higher than the maximum operative temperature.          | Ta = 125 °C<br>JESD22a103  |
| <b>PC (JL3):</b> Preconditioning (solder simulation)             | The device is submitted to a typical temperature profile used for surface mounting, after controlled moisture absorption   |  |
| <b>TC:</b> Temperature Cycling                                   | The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere   | Ta Cycling: -40 °C ±125 °C<br>JESD22a104                                 |
| <b>ESD (HBM):</b> Electrostatic Discharge (Human Body Model)     | The device is submitted to a high voltage peak on all his pins simulating ESD stress according to different simulation models.   | Voltage ±2000 V<br>JEDEC / JESD22-A114E                                  |
| <b>ESD (MM):</b> Electrostatic Discharge (Machine Model)         |  | Voltage ±200 V<br>JEDEC/JESD-A115-A                                      |
| <b>ESD (CDM):</b> Electrostatic Discharge (Charged Device Model) |  | Voltage ±750 V<br>ANSI / ESD STM 5.3.1 ESDA                              |
| <b>LU (CI):</b> Latch-up (Overvoltage and Current Injection)     | The device is submitted to a direct current forced/sunk into the input/output pins. Removing the direct current, no change in the supply current must be observed.           | Current injection ±200 mA<br>Overvoltage 1.5 x Vmax<br>EIA/JESD78        |
| <b>THB:</b> Temperature Humidity Bias                            | The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions for ambient temperature and relative humidity.   | Vdd(nom) = 2.7 V<br>T = 85 °C / RH = 85%<br>JESD22a108                   |
| <b>LTS:</b> Low Temperature Storage                              | The device is stored in an unbiased condition at the min. temperature allowed by the package materials, sometimes lower than the min. op. temp                               | Ta = -40 °C<br>JESD22a119  |
| <b>MS:</b> Mechanical Shock                                      | The device is submitted to 10000 g / 0.1 ms<br>5 shocks for each axis.   | 10000 g / 0.1 ms<br>5 shocks for each axis, under bias<br>MIL STD 883MIL |

## 7 Revision history

**Table 8: Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 17-Nov-2016 | 1        | Initial release  |
| 31-Aug-2017 | 2        | Updated <i>Figure 3: "MP23AB01DH electrical connections and external component values"</i> |

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